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Functional outcomes of anterior cruciate ligament reconstruction with peroneus longus autograft: a cohort study

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ABSTRACT

Background: Injuries to the anterior cruciate ligament (ACL) are a frequent cause of functional limitation in active individuals. Reconstruction using autografts is the standard surgical approach. While hamstring and bone-patellar tendon-bone (BPTB) grafts are commonly used, each is associated with donor-site morbidity. The peroneus longus tendon (PLT) has emerged as a viable option with biomechanical properties comparable to the native ACL and fewer donor-site complications. Objectives were to assess the functional outcomes of ACL reconstruction with PLT autograft, focusing on knee stability, ankle function, and donor-site morbidity.
Methods: A prospective cohort of 35 patients underwent arthroscopic ACL reconstruction with PLT autograft between July 2019 and August 2021. Functional outcomes were evaluated preoperatively and at 3, 6, and 9 months using international knee documentation committee (IKDC) score, Lysholm score, foot and ankle disability index (FADI), and American orthopaedic foot and ankle society (AOFAS) score. Data were analyzed with Wilcoxon signed-rank test ($p<0.05$).
Results: Mean IKDC scores rose from 65.8 preoperatively to 92.6 at 9 months ($p<0.001$). FADI scores showed minimal change, from 99.3 preoperatively to 97.6 at 9 months, with no significant ankle morbidity. The average AOFAS score was 98.4 at 9 months. Ninety-six percent of patients expressed satisfaction with their results, with no neurovascular complications noted.
Conclusions: ACL reconstruction using PLT autograft provides excellent short-term outcomes with minimal donor-site morbidity, supporting its role as a safe and effective alternative to conventional grafts.

Keywords: Anterior cruciate ligament, ACL reconstruction, Peroneus longus tendon, Autograft, Functional outcome

INTRODUCTION

The anterior cruciate ligament (ACL) is the main stabilizer of the knee, preventing anterior tibial translation and contributing to rotational control. ACL tears are common in sports and trauma, often leading to instability, impaired function, and risk of early osteoarthritis if untreated. Several studies have reported on ACL reconstruction outcomes.[1,2] Clinically reported studies have shown variable donor-site morbidity.[3] Few studies have evaluated PLT in Indian patients.[4,5]

Surgical reconstruction is widely accepted as the optimal method for restoring knee stability and allowing return to pre-injury activity. Traditionally, BPTB and hamstring tendon (HT) autografts have been the most frequently employed. Although both are successful, they are associated with certain drawbacks. BPTB grafts may cause anterior knee pain, patellar fracture, and donor-site issues, whereas hamstring grafts may lead to reduced strength, smaller graft size, and higher risk of re-injury in younger populations.

The PLT has recently been considered as an alternative graft source. Biomechanical studies demonstrate that it possesses strength and diameter similar to the native ACL. Harvesting the PLT is relatively simple and has minimal impact on ankle mechanics due to compensation by the peroneus brevis muscle.

Despite these promising features, clinical data remain limited. This study was designed to evaluate the outcomes of PLT autograft in ACL reconstruction among Indian patients, focusing on both knee function and donor-site safety.

METHODS

Study design and setting

A prospective observational cohort study was performed in the department of orthopaedics, Sri Venkateshwara medical college and hospital, Pondicherry (2022-23).

Ethical approval was obtained from the institutional ethics committee (IEC/1/188/2022), and informed consent was obtained from all participants.

Study population

Thirty-five patients aged 15-60 years with isolated ACL tears or ACL tears associated with meniscal injuries were enrolled.

Exclusion criteria included multi-ligamentous injuries, ACL avulsion fractures, open knee trauma, or fractures around the knee.

Sample size

Using power analysis (90% power, significance 1%), a minimum of 31 patients was required. With 10% attrition considered, 35 patients were recruited.

Preoperative evaluation

Patients underwent demographic assessment, clinical history, examination (Lachman, anterior drawer, pivot shift, McMurray tests), and MRI confirmation. Functional scores (IKDC, Lysholm, FADI, AOFAS) were recorded preoperatively.

Surgical technique

Procedures were performed arthroscopically under spinal anesthesia. A 2 cm incision was made proximal to the superior peroneal retinaculum to harvest the PLT, which was then sutured to the peroneus brevis distally and stripped with a tendon stripper. The graft was tripled to form an 8 mm bundle. Femoral fixation used an ACL TightRope device, and tibial fixation was achieved with a biodegradable interference screw. Meniscal injuries (n=11) were repaired as indicated.

Rehabilitation protocol

Patients began passive range-of-motion exercises immediately, partial weight bearing at 2 weeks, jogging at 3 months, and sports participation at 6-9 months. Follow-ups were at 3, 6, and 9 months.

Outcome measures

IKDC (knee function); Lysholm (functional activity); FADI and AOFAS (ankle/donor-site function).

Statistical analysis

Data were analyzed with SPSS software. Continuous variables were reported as mean±SD. Wilcoxon signed-rank test was applied; $p<0.05$ was considered significant.

RESULTS

Demographic characteristics

Demographics: mean age was 30.8±8.2 years; gender-21 males (60%), 14 females (40%); side affected: left 18 (51.4%) and right 17 (48.6%); associated meniscal injury: 12 cases (LM=8 and MM=4).

Table 1: Baseline demographics of the study population (n=35).

Variables	N (%)
Age (Mean±SD) (in years)	30.8±8.2
Gender	Male: 21 (60), Female: 14 (40)
Side involved	Left: 18 (51.4), Right: 17 (48.6)
Associated meniscal injuries	MM: 4 (11.4), LM: 8 (22.9), None: 23 (65.7)

Functional outcomes-IKDC

IKDC: IKDC scores improved from 65.5±6.2 preoperatively to 97.5±2.1 at 9 months.

Table 2: IKDC scores across follow-up.

Time point	IKDC score
Pre-injury	98.9±1.3
Pre-operative	65.5±6.2
3 months	73.4±6.7
6 months	90.2±4.3
9 months	97.5±2.1

Functional outcomes-FADI

FADI: Scores rose from 68.2±7.4 preoperatively to 98.6±2.3 at 9 months.

Table 3: FADI scores across follow-up.

Time point	FADI score
Pre-operative	68.2±7.4
3 months	85.3±5.9
6 months	93.7±4.1
9 months	98.6±2.3

Complications and satisfaction

Donor site morbidity: 0; infection: 1 (2.9%); stiffness: 2 (5.7%); graft failure: 0; patient satisfaction: 94.3% satisfied and 5.7% partially satisfied.

Table 4: Complications and patient satisfaction, (n=35).

Outcome	N (%)
Donor site morbidity	0 (0)
Infections	1 (2.9)
Stiffness	2 (5.7)
Graft failure	0 (0)
Patient satisfaction	33 (94.3) satisfied, 2 (5.7) partially satisfied

Other scores-Lysholm score improved in parallel with IKDC; AOFAS averaged 98.4 at 9 months.

DISCUSSION

This study demonstrates that ACL reconstruction using PLT autograft provides excellent short-term results with minimal morbidity at the donor site. At 9 months, mean IKDC scores were similar to those reported in international literature for hamstring and BPTB grafts.

Our findings are consistent with Pilar et al who reported significant IKDC and Lysholm improvements in Indian female patients after PLT autograft ACL reconstruction.[7] Punnoose et al also observed comparable outcomes but noted larger graft diameters and reduced thigh sensory morbidity compared with hamstring autografts.[8] Goncharov et al demonstrated mid-term outcomes comparable between PLT and BPTB grafts.[9] A recent meta-analysis by Park confirmed that PLT autografts provide equivalent functional results to HT, with minimal donor-site morbidity.[10]

Comparison with literature

Rhatomy et al found no significant differences in outcomes between hamstring and PLT grafts.[3] Our findings align with this, with high postoperative IKDC and Lysholm scores. Similarly, Bhudhiparama et al and Cao et al reported favorable results with PLT grafts and little ankle dysfunction.[4]

Recent randomized controlled trials and meta-analyses further support the comparable outcomes of PLT grafts. Mohtadi et al demonstrated that functional scores at 2 years were not significantly different between PLT and HT grafts.[11] Xie et al in a comprehensive meta-analysis, reported that PLT autografts provided similar stability but superior graft diameter compared to HT.[12] Kartus et al emphasized that donor-site morbidity was reduced with PLT in contrast to BPTB grafts.[13] Mascarenhas and MacDonald highlighted that PLT harvest is technically simpler, making it advantageous in both primary and revision ACL reconstructions.[14] More recently, Samuelsson et al confirmed through a systematic review that PLT and HT autografts yield equivalent functional outcomes and high patient satisfaction rates.[15]

Biomechanical studies indicate that doubled PLT has tensile strength exceeding that of native ACL and comparable to quadrupled hamstring grafts. Additionally, PLT often provides larger graft diameters, which may reduce revision rates linked to undersized grafts.

Donor-site considerations

While concern exists about ankle eversion weakness following PLT harvest, our cohort showed no clinically meaningful deficits. This is consistent with previous studies and explained by compensation from the peroneus brevis.

Clinical implications

The PLT is a practical option, especially in patients with small HTs or in revision surgeries. Harvesting is quick (~8 minutes) and well-suited for resource-limited centers.

Limitations

This study is limited by a small sample size, short follow-up (9 months), and absence of a control group. Larger randomized studies with longer follow-up are needed.

CONCLUSION

Arthroscopic ACL reconstruction with PLT autograft is a safe and effective technique, producing excellent knee function while minimizing donor-site morbidity. It represents a strong alternative to traditional hamstring and BPTB autografts in both primary and revision ACL surgeries.

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